DIVISION OF FOREST PEST CONTROL

Northeastern Area State & Private Forestry

A-70-5 INTERIM REPORT 5230

PUPAL SAMPLING OF THE SADDLED PROMINENT CATERPILLAR HETEROCAMPA GUTTIVITTA (WLKR) IN WESTERN MASSACHUSETTS

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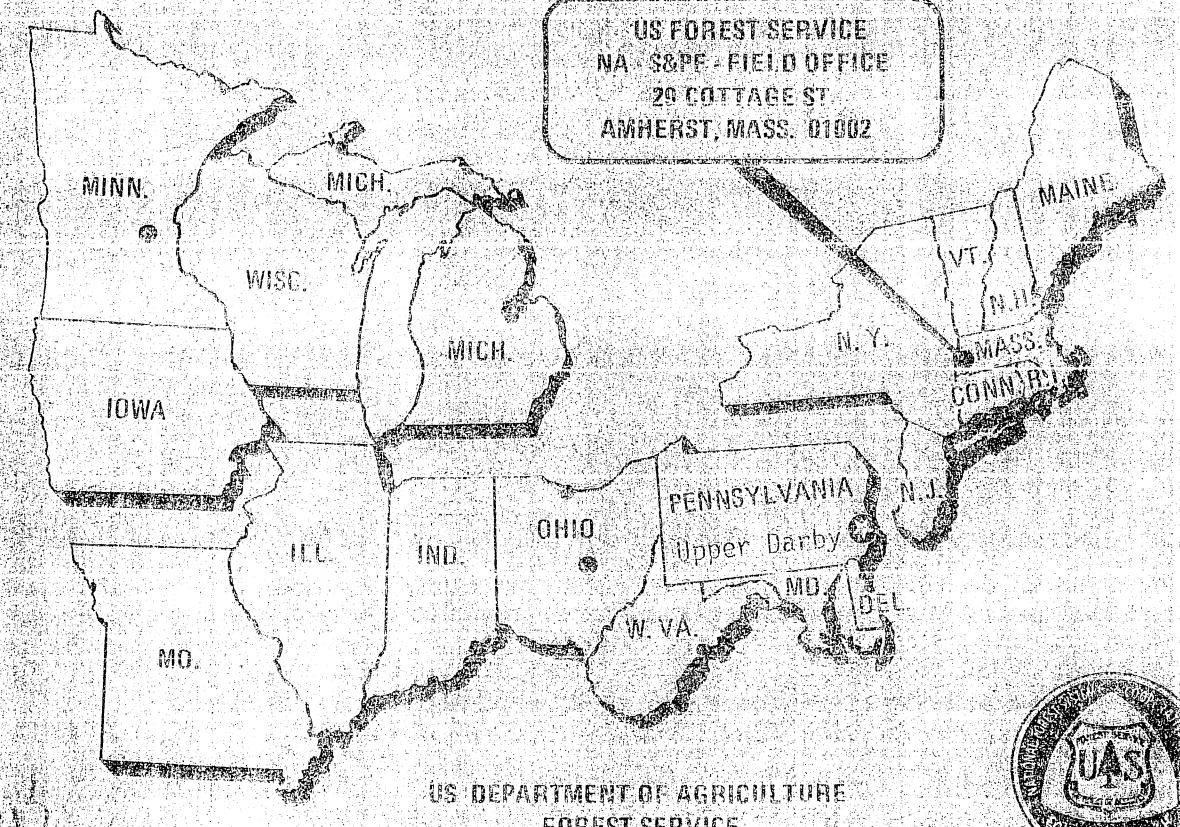

US DEPARTMENT OF AGRICULTURE
FOREST SERVICE

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ABSTRACT

Three ten acre plots were established in western Massachusetts for the purpose of gathering information on pupal populations of the saddled prominent caterpillar (Heterocampa guttivitta (Wlkr.)) and correlating such information with subsequent defoliation or potential thereof.

INTRODUCTION

The saddled prominent caterpillar (Heterocampa guttivitta (Wlkr)) has recently been very active throughout New England, New York, and Pennsylvania causing severe defoliation of beech and sugar maple over extensive areas. Overwintering pupal populations offer possiblities as an indicator of potential defoliation the following year; with this in mind a work plan was written and implemented to explore these possiblities. The field work was conducted in Berkshire County, Mass., during the period of May through August 1969, and essentially follows procedure proposed by the Applied Forestry Research Institute of New York and the New York Bureau of Forest Insect & Disease Control.

OBJECTIVES

The objectives in this work were (1) to gather information concerning the adequacy of a pupal sampling system devised by the State of New York and (2) to determine the validity of the reputed habit that this insect has of aggregating its pupae on specific microhabitats.

The work plan was drawn up by members of the Amherst Field Office, Forest Pest Control and the field work was carried out by members of the Amherst Forest Pest Control staff. Mr. Albert Genest, Forest Pest Supervisor for the Pittsfield State Forest, Pittsfield, Mass., assisted in the field work, provided topographic and vicinity maps of the area, and was of considerable help in locating areas in which plots could be established.

TECHNICAL INFORMATION

Causal Agent - Heterocampa guttivitta (Walker), Saddled Prominent

Host Trees - In 1968 Sugar Maple (Acer saccharum) and beech (Fagus grandifolia) were severly defoliated by the saddled prominent caterpillar. Although these caterpillars preferred sugar maple and beech, other deciduous hardwoods were also eaten. Ash (Fraxinus spp), soft maple (Acer rubrum), black cherry (Prunus serotina) were not preferred hosts. The caterpillars were observed feeding on Spiraea spp., black berry (Rubus spp.) and hobblebush (Viburum alnifolium). Birch (Betula spp) was the least preferred host for these caterpillars.

Location of Infestation

The infested area covered the western and eastern slopes of the Taconic

Mountains bordering Massachusetts and New York, the eastern slope of Brodie Mountain and southerly to the October Mt. State Forest. There were scattered infestations on Mt. Greylock Reservation, on North Weston Mountain, in the vicinity of Hinsdale Center between Cleveland Reservoir and Ashmere Lake Dam in the town of Hinsdale, and the Peru State Park in the town of Peru. In 1968, aerial surveys conducted by Albert Genest delineated the infested area (see map). Approximately 30,000 acres of beech and sugar maple were infested by the saddled prominent in 1968.

SURVEY METHODS

Pupal samplings were conducted on October Mt. State Forest and Brodie Mt. in an attempt to predict defoliation from pupal counts. Instructions are in the work plan, "Conducting Pupal Sampling Techniques for Saddled Prominent Caterpillar (Heterocampa guttivitta)" devised by the Bureau of Forest Insect & Disease Control, New York Conservation Department were followed with minor modification.

Three permanent plots, each consisting of 10 acres, were established in Berkshire County, Mass.; two on October Mt. State Forest and one on the eastern slope of Brodie Mt. The western slope, which faces Taconic Mountain, did not have any appreciable defoliation in 1968 (see maps). Defoliation in these areas had been extremely heavy (80%-100% Foliage stripping) in 1968.

These areas were laid out in cardinal directions as described in the work plan. Corner trees were marked with three horizontal strips of orange paint. Perimeter trees were marked with orange paint.

Plot layouts were established using a compass and pacing according to the work plan. Time studies conducted indicate that it takes 50-60 man hours to complete one plot. This includes plot layout as well as the sampling procedure. Plot layout requires less than 20% of the total time.

One by one foot, $\frac{1}{4}$ inch mesh screened frames made for taking duff and soil samples were not used because the material did not pass through the screen. One square foot pieces of cardboard on one foot sticks were substituted for the screened frames.

Pupae collected were recorded in the following categories: Living pupae, dead pupae, and pupal skins of previous generation or current pupae broken open by parasites or predators. All live pupae from each subplot were placed in separate, clearly marked one pint cardboard canisters. All other pupae, cocoons, puparia, predators and parasites were placed in other canisters.

RESULTS AND DISCUSSIONS

It was difficult to ascertain whether pupae were located in specific microhabitats; however, these insects do exhibit a strong preference for litter and duff for pupation rather than mineral soil. One live pupa was

found in the soil, the remainder were in organic material.

Sampling procedure yielded the information summarized in the following table:

TABLE

Summary of Saddled Prominent Pupal Sampling - May, 1969

Pupal Count Per 1 Square Foot Per Plot*

Plot	Total No. of Live Pupae	Total Area Examined (sq. ft.)	AV. No. of Live Pupae Per sq. ft.	Per Cent Defoliation 1969
1	57	64	0.89	80-100
2	75	59	1.23	80-100
3	74	72	1.02	80-100

* Field data sheets are on file at the Amherst Field Office. Copies of these sheets have been sent to Dr. Dave Grimble, AFRI in Syracuse, New York.

Pupae were subjected to heavy feeding by rodents, moles and/or shrews. Where rodent undermining was evident, the pupal counts were generally lower. This undermining was evident where sugar maple and beech were the co-dominant species.

On May 21, 1969, moths were emerging from the duff when sampling began on Plot 3. One saddled prominent moth emerged and was caught in Plot 2 on May 16, 1969. However, the first really heavy emergence of moths began on May 22, 1969.

The three plots were similar in topography and physiography with many rocks and deep depressions. A brook transversed a subplot in Plot 1.

According to information compiled by the New York Conservation Department in 1968, one pupa per square foot in the fall or 0.5 pupae per square foot in the spring was sufficient to result in heavy to complete defoliation. Pennsylvania reported that they sampled pupae on eight different plots scattered throughout the infested area. Plots were sampled by taking four (4) one-square foot samples from each of five locations under selected defoliated beech and sugar maple trees. In 1968 they reported that defoliation ran from 20-50% for 1.2 pupae per square foot to 80-100% for 4.2 pupae per sq. foot.

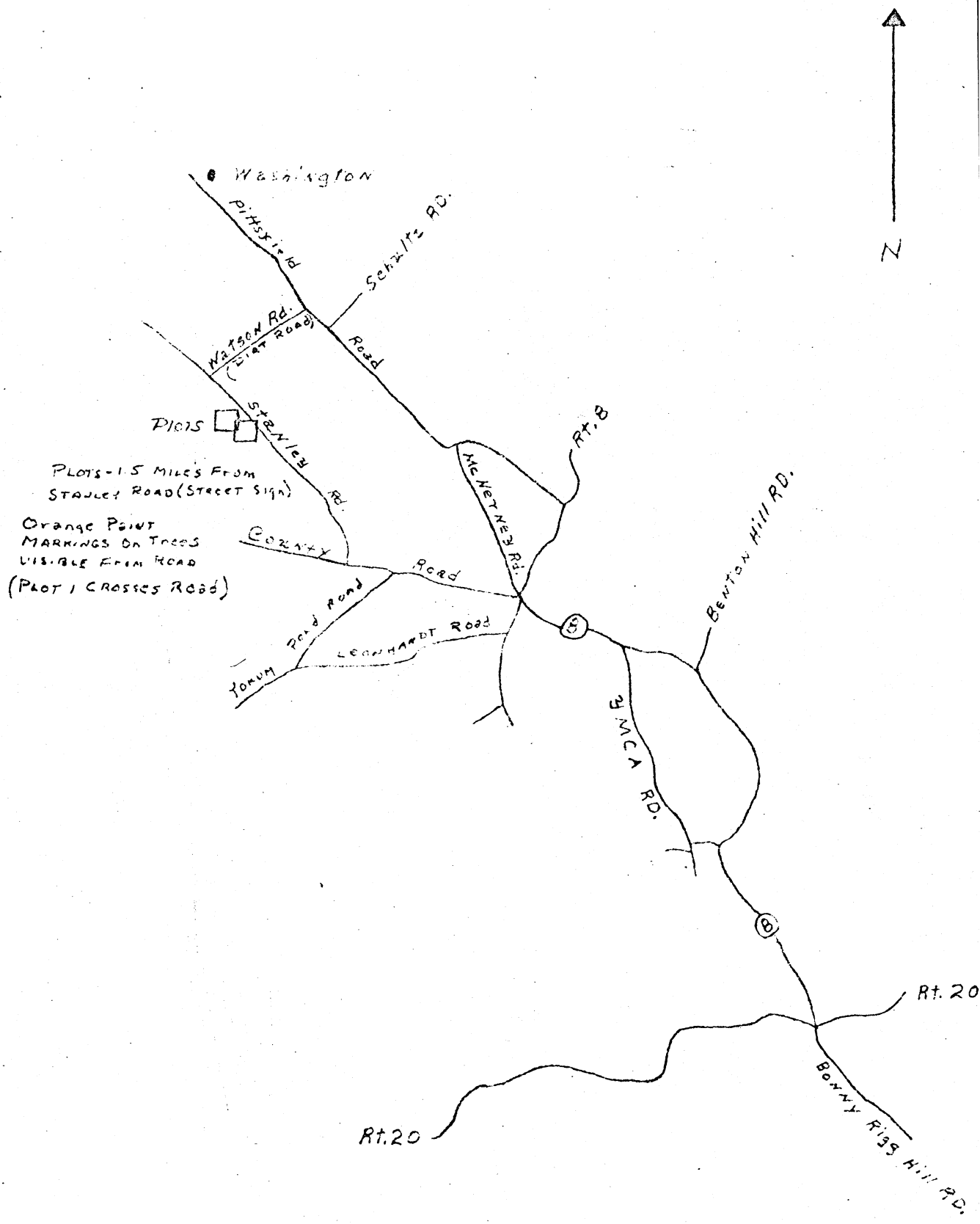
The system for correlating pupal count with defoliation intensity has not been fully worked out by either New York Conservation Department or Pennsylvania Department of Forests and Waters.

No statistical analysis was attempted to determine if there were any significant differences in the plots or subplots. The information gathered in this report will be sent to Dr. Dave Grimble. Project Leader in Charge of the Saddled Prominent Caterpillar, Applied Forestry Research Institute, Syracuse University, so that all data on pupal surveys from the Northeast may be pooled. The data does indicate pupal counts of 1.0* pupae per square foot on the areas sampled and in each area 80% or more of the foliage was stripped from the beech and sugar maple components of the stands in 1969.

RECOMMENDATIONS

It is recommended that the Amherst Field Office and the Massachusetts Department of Natural Resources cooperate in fall and spring pupal sampling surveys of this insect in order to detect population changes on these permanent plots.

It is also recommended that the Amherst Field Office and the Massachusetts Department of Natural Resources sample these plots in the spring 1970 using the same work plan, but moving the subplots back a $\frac{1}{2}$ chain from the original sampled subplots. The microhabitat studies of 80.00 sq. ft. which were selected on each line of a plot will be dropped in the spring.



Scale - 6000 ft. to 2N inch

DIAGRAM OF PLOT I AND 2

OCTOBER MOUNTAIN STATE FOREST, WASHINGTON, MASS.

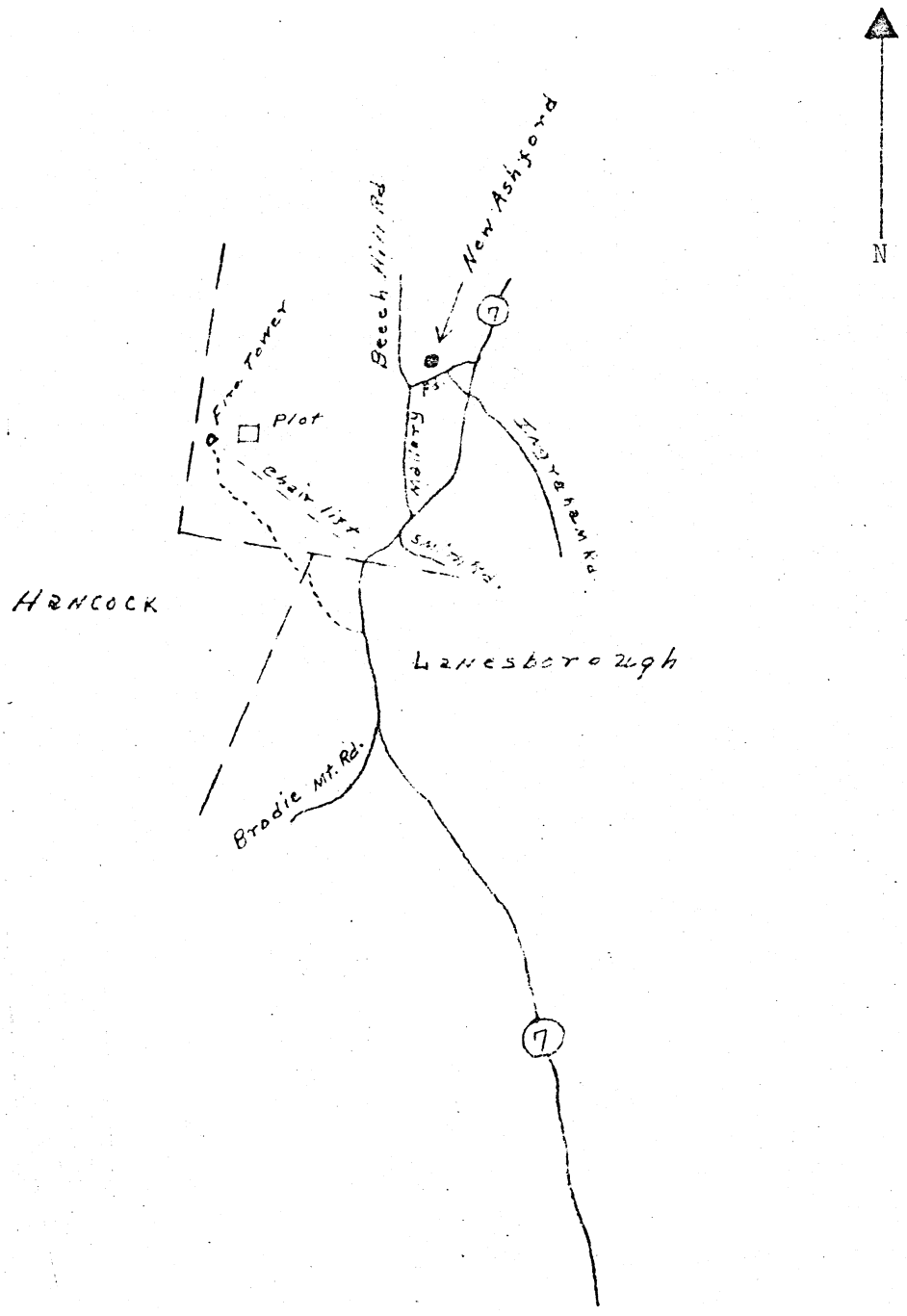
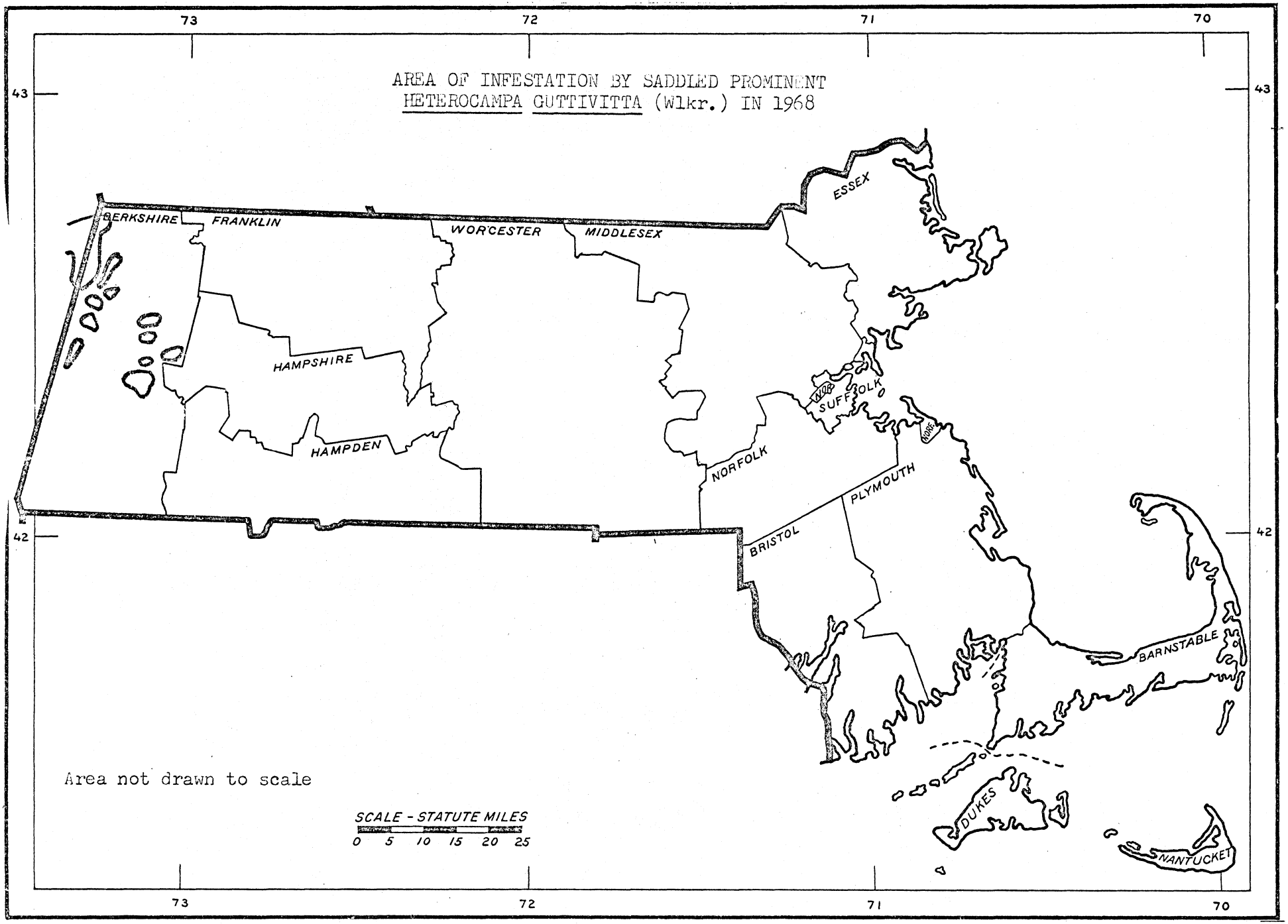


DIAGRAM OF PLOT 3

BRODIE MOUNTAIN, NEW ASHFORD, MASS.

Scale - 6000 ft. to an inch

MASSACHUSETTS



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MASSACHUSETTS

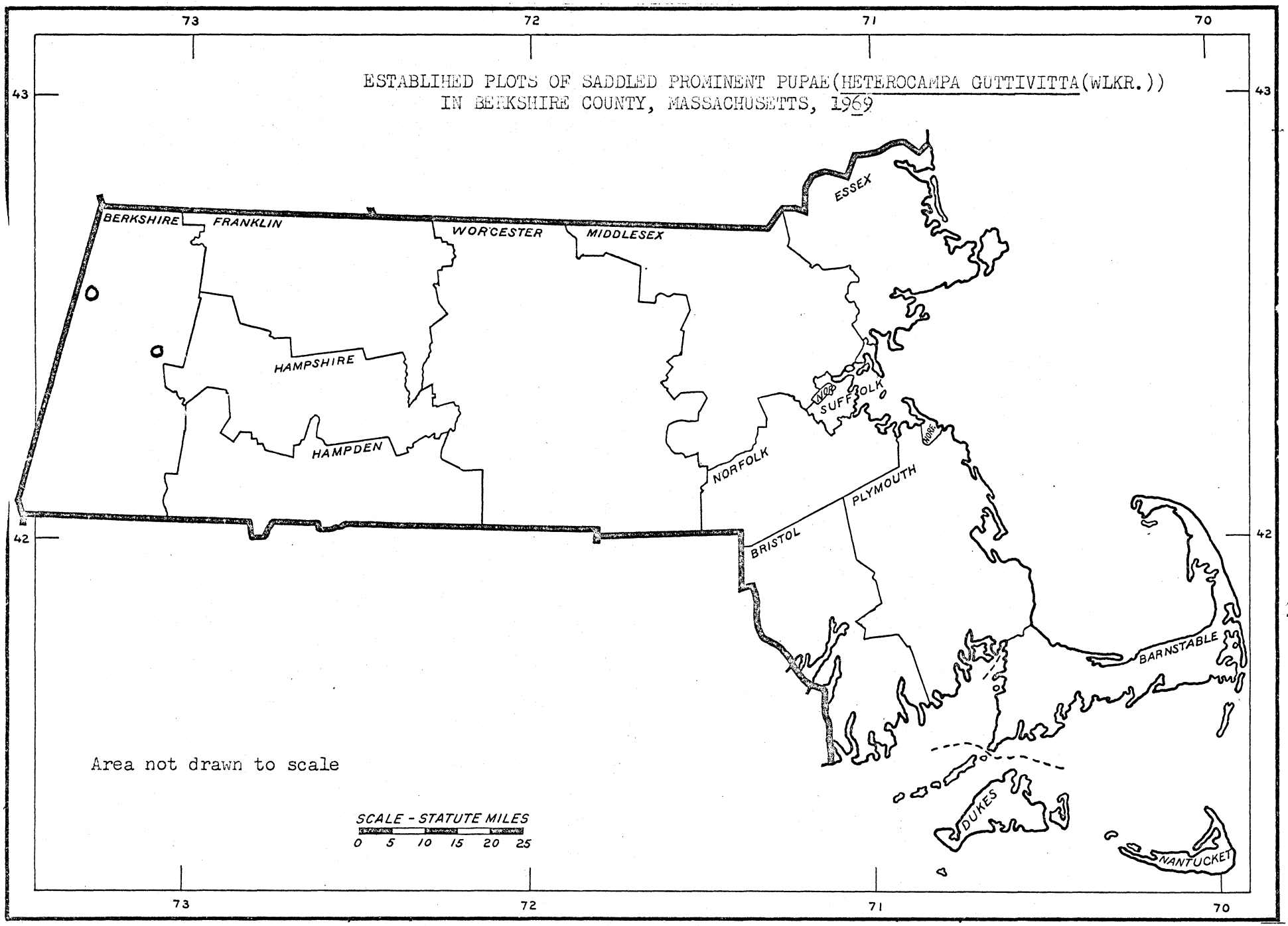

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TABLE I

Saddled Prominent Pupal Sampling on October Mountain State Forest, Berkshire County, Mass. - May 1969

Plot 1

Sub-plot	Line 1																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0
2	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0
3	0	0	1	0	0	0	0	0	0	0	0	0	1	2	12	0	0	0	0	0	0	0	0	0
4	3	1	2	0	0	0	0	1	0	0	0	0	2	2	1	0	0	0	1	1	6	0	0	0
Total	3	1	4	0	0	0	0	1	1	0	0	0	3	4	16	1	0	0	2	1	8	0	0	0

Key:

LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).

DP = Pupae judged to be dead but intact unless damaged in sampling.

PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:

1. No. of live pupae in subplots = 8
2. Total area examined = 16 sq. ft.
3. Major species of trees were mixed stands of sugar maple, beech, black ash, black cherry.

Note: Revised from Saddled Prominent Summary Table, N. Y. State Conservation Dept.

TABLE II

Saddled Prominent Pupal Sampling on October Mountain
State Forest, Berkshire County, Mass. - May 1969

Plot 1

Sub-plot	Line 2																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	1	0	2	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0
2	4	1	2	0	0	0	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
3	1	0	1	0	0	0	1	0	0	0	0	0	2	0	2	0	0	0	1	0	0	0	0	0
4	5	0	2	0	0	0	0	0	0	0	0	0	1	0	9	0	0	0	0	0	0	0	0	0
Total	11	1	7	0	0	0	2	0	1	0	0	0	4	0	15	0	0	0	1	0	6	0	0	0

Key:

LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:

1. No. of live pupae in subplots = 18.
2. Total area examined = 16 sq. ft.
3. Major species of trees were mixed stands of maple, beech, black cherry, and birch.

Note: Revised from Saddled Prominent Summary Table, N.Y. State Conservation Dept.

TABLE III

Saddled Prominent Pupal Sampling on October Mountain
State Forest, Berkshire County, Mass. - May 1969

Plot 1

Sub-plot	Line 3																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1			Swamp						Swamp						Swamp						Swamp			
2	0	0	1	0	0	0	2	0	1	0	0	0	6	1	0	0	0	0	2	0	0	0	0	0
3	0	0	3	0	0	0	2	0	3	0	0	0	2	0	3	0	0	0	1	0	1	0	0	0
4	1	0	2	0	0	0	1	0	1	0	0	0	2	0	3	0	0	0	0	0	4	0	0	0
Total	1	0	6	0	0	0	5	0	5	0	0	0	10	1	6	0	0	0	3	0	5	0	0	0

Key:
LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:
1. No. of live pupae in subplots = 19.
2. Total area examined = 12 sq. ft.
3. Major species of trees were mixed stands of beech, maple, birch, and black ash.

NOTE: (1) Individual single subplots in swamp were considered as a point.

(2) Revised from Saddled Prominent Summary Table, N.Y. State Conservation Dept.

TABLE IV

Saddled Prominent Pupal Sampling on October Mountain
State Forest, Berkshire County, Mass. - May 1969

Plot 1

Sub-plot	Line 4																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	0	0	0	0	0	0	0	0	2	0	0	0	1	0	3	0	0	0	0	0	1	0	0	0
2	0	0	1	0	0	0	3	1	5	0	0	0	0	0	6	0	0	0	3	0	1	0	0	0
3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	1	0	0	0	1	0	3	1	0	0	0	0	0	0	0	0
5	2	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2	1	9	0	0	0	3	1	8	0	0	0	2	0	12	0	0	0	3	0	2	0	0	0

Key:
LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:
1. No. of live pupae in subplots = 10.
2. Total area examined = 20 sq. ft.
3. Major species of trees were mixed stands of sugar maple, beech, and birch.

Note: Revised from Saddled Prominent Summary Table, N.Y. State Conservation Dept.

TABLE V

Saddled Prominent Pupal Sampling on October Mountain
State Forest, Berkshire County, Mass. - May 1969

Plot 2

Sub-plot	Line 1																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	3	0	0	0	0	0	1	0	3	0	0	0	5	1	2	0	0	0			Swamp			
			Swamp						Swamp						Swamp						Swamp			
3	0	0	1	0	0	0	0	1	2	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0
4	1	0	0	0	0	0	3	0	1	0	0	3	0	0	0	0	0	0	3	1	2	0	0	0
Total	4	0	1	0	0	0	4	1	6	0	0	0	9	1	3	0	0	0	4	1	2	0	0	0

Key:
LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:
1. No. of live pupae in subplots = 21.
2. Total area examined = 11 sq. ft.
3. Major species of trees were mixed stands of sugar maple, beech, black ash, black cherry, and birch.

Note: Individual single subplots in swamp were considered as a point.

TABLE VI

Saddled Prominent Pupal Sampling on October Mountain State Forest, Berkshire County, Mass. - May 1969

Plot 2

Subplot	Line 2																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	10	1	0	0	0	0	0	0	0	0	0	0	8	1	0	0	0	0	4	2	3	0	0	0
2	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
3	2	0	1	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0
4	1	0	1	0	0	0	1	0	1	0	0	0	8	0	3	0	0	0	1	0	1	0	0	0
Total	13	1	3	0	0	0	1	0	3	0	0	0	8	2	5	0	0	0	5	2	6	0	0	0

Key:

LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).

DP = Pupae judged to be dead but intact unless damaged in sampling.

PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:

1. No. of live pupae in subplots = 23.
2. Total area examined = 16 sq. ft.
3. Major species of trees were mixed stands of sugar maple, beech, birch, and black cherry.

TABLE VII

Saddled Prominent Pupal Sampling on October Mountain
State Forest, Berkshire County, Mass. - May 1969

Plot 2

Sub-plot	Line 3																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	1	0	5	0	0	0	0	0	0	0	0	0	2	1	2	0	0	0	2	0	1	0	0	0
2	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	3	0	0	0
3	4	1	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	1	2	4	0	0	0
4	1	0	0	0	0	0	0	0	2	0	0	0	1	0	4	0	0	0	1	0	3	0	0	0
Total	9	1	5	0	0	0	3	0	3	0	0	0	4	1	0	0	0	0	5	2	11	0	0	0

Key:
LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:
1. No. of live pupae in subplots = 21.
2. Total area examined = 16 sq. ft.
3. Major species of trees were mixed stands of sugar maple and beech. First saddled prominent adult emerged from this line 4/21/69.

TABLE VIII

Saddled Prominent Pupal Sampling on October Mountain
State Forest, Berkshire County, Mass. - May 1969

Plot 2

Sub-plot	Line 4																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	0	0	2	0	0	0	0	0	2	0	0	0	2	1	3	0	0	0	2	0	0	0	0	0
2	0	0	1	0	0	0	0	1	4	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
3	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
4	1	1	3	0	0	0	1	0	6	0	0	0	1	0	8	0	0	0	1	0	2	0	0	0
Total	1	1	6	0	0	0	2	1	13	0	0	0	3	2	12	0	0	0	4	0	3	0	0	0

Key:

LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae broken open by parasites or predators.

Comments:

1. No. of live pupae in subplots = 10.
2. Total area examined = 16 sq. ft.
3. Major species of trees were mixed stands of sugar maple, black cherry, and beech.

TABLE IX

Saddled Prominent Pupal Sampling on Brodie Mountain,
Berkshire County, Mass. - May 1969

Plot 3

Sub-plot	Line 1																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0
2	1	1	2	0	0	0	1	0	1	0	0	0	2	1	2	0	0	0	1	1	3	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	1	6	0	0	0
4	0	0	2	0	0	0	0	0	4	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0
Total	2	1	2	0	0	0	1	0	5	0	0	0	7	1	3	0	0	0	4	2	10	0	0	0

Key:

LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae open by parasites or predators.

Comments:

1. No. of live pupae in subplots = 14.
2. Total area examined = 16 sq. ft.
3. Major species of trees were mixed stands of beech, sugar maple, and black ash.

TABLE X

Saddled Prominent Pupal Sampling on Brodie Mountain,
Berkshire County, Mass. - May 1969

Plot 3

Sub-plot	Line 2																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
2	0	0	2	0	0	0	2	0	5	0	0	0	0	0	1	0	0	0	1	0	3	0	0	0
3	4	2	0	0	0	0	0	0	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	1	0	2	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0
Total	4	3	11	0	0	0	3	0	9	0	0	0	5	0	1	0	0	0	1	0	8	0	0	0

Key:
LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae open by parasites or predators.

Comments:
1. No. of live pupae in subplots = 13.
2. Total area examined = 16 sq. ft.
3. Major species of trees were mixed stand of beech, sugar maple, and black cherry.

TABLE XI

Saddled Prominent Pupal Sampling on Brodie Mountain
Berkshire County, Mass. - May 1969

Plot 3

Sub-plot	Line 3																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	3	0	4	0	0	0	1	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	5	0	0	0	0	0	1	0	1	0	0	0	3	0	3	0	0	0
3	0	0	0	0	0	0	1	1	4	0	0	0	2	0	1	0	0	0	1	0	5	0	0	0
4	3	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0
5	3	0	0	0	0	0	0	0	0	0	0	0	4	0	2	0	0	0	1	0	1	0	0	0
Total	10	0	6	0	0	0	7	1	7	0	0	0	9	0	4	0	0	0	5	0	11	0	0	0

Key:

. LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae open by parasites or predators.

Comments:

1. No. of live pupae in 8 subplots = 31.
2. Total area examined = 20 sq. ft.
3. Major species of trees were mixed stands of sugar maple, beech, and black ash.

TABLE XII

Saddled Prominent Pupal Sampling on Brodie Mountain,
Berkshire County, Mass. - May 1969

Plot 3

Sub-plot	Line 4																							
	North						South						East						West					
	Duff			Soil			Duff			Soil			Duff			Soil			Duff			Soil		
	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS	LP	DP	PS
1	1	0	1	0	0	0	2	0	2	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0
3	1	0	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	1	0	1	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0
5	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Total	3	0	6	0	0	0	6	0	4	0	0	0	4	0	7	0	0	0	3	0	1	0	0	0

Key:
LP = Pupae judged to be living and viable (including those damaged in sampling which would have been otherwise judged as living).
DP = Pupae judged to be dead but intact unless damaged in sampling.
PS = Old pupal skins of previous generation and current pupae open by parasites or predators.

Comments:
1. No. of live pupae in subplots = 16.
2. Total area examined = 20 sq. ft.
3. Major species of trees were mixed stands of sugar maple, beech, and black ash.